

IN THE CLAIMS

1. (currently amended) A surface and subsurface operational watercraft having an elongated body with a forward end and a rearward end, said watercraft being further characterized in having:

- a) A weight and a power means;
- b) Said elongated body having a planform which is generally triangular with a narrow end forward and a broader portion adjacent said stern with said elongated body when floating in static water having a first submerged volume with a profile in side view which is generally a long triangle with base adjacent said forward end and a narrow end adjacent said rearward end;
- c) Said elongated body having right and left lateral wings;
- d) Said watercraft being capable of operating in, at and below the surface of water;
- e) Said first submerged volume generating an upward buoyant force equal to the weight of said watercraft, with said elongated body having a second volume above said first volume sufficient to permit surface operation of said watercraft with a significant positive reserve buoyancy margin;
- f) Said watercraft being capable of moving forward in water under the action of said power means in an efficient and sustained manner;
- g) Said wings being at least partially submerged when said watercraft is operating at the surface

1 of water at a dive speed;

2
3 h) Said wings at said dive speed operative to generate a ~~said~~ downward hydrodynamic force
4 sufficient to overcome the upward buoyant force of said positive reserve buoyancy margin
5 when submerged;

6
7 i) Said wings at a submerged speed operative to generate a downward hydrodynamic force
8 sufficient to counter the lifting forces generated by said second volume when submerged;

9
10 j) Whereby said vessel can operate submerged in an efficient and sustained manner.
11

12 2. (original) The watercraft of claim 1 wherein said wings are adapted to move with their
13 trailing edge upwards to submerge said watercraft at said dive speed and retain the submerged
14 condition at a submerged speed.
15

16 3. (original) The watercraft of claim 1 in which said wings have movable trailing edge
17 flaps which are adapted to move upwards to generate a downward hydrodynamic force and
18 downwards to generate a lifting force.
19

20 4. (previously amended) The watercraft of claim 1 further characterized:
21

22 a) Said broader portion adjacent said stern has a broad beam in planview forming the trailing
23 edge of said elongated body;

24
25 b) In that the combined profile shape of said first and second volumes adjacent said rearward
26 end tapers in side view smoothly in a rearward direction with upper and lower surface
27 portions meeting at said rearward end.
28

1
2 5. (canceled)

3
4 6. (currently amended) The watercraft of claim 4 further comprising a movable flap
5 mounted on said rearward end, adapted to be moved downwards to selectively dive said watercraft
6 and ~~and/or~~ pitch down said watercraft, and upwards to selectively climb towards the water surface
7 and ~~and/or~~ pitch up said watercraft.

8
9 7. (currently amended) The watercraft of claim 6 ~~claim 4~~ in which the span of said flap
10 is approximately equal to the beam at the rearward end of said elongated body.

11
12 8. (original) The watercraft of claim 7 with the chord of said flap being no less than
13 approximately 2.5% of the length of said elongated body.

14
15 9. (previously amended) The watercraft of claim 1 in which said wings are located
16 adjacent the midbody portion of said elongated body between said forward and rearward ends.

17
18 10. (original) The watercraft of claim 1 in which the angle of incidence of said wings
19 relative to said elongated body is adjustable symmetrically up and down to cause upward and
20 downward forces on said watercraft.

21
22 11. (original) The watercraft of claim 10 in which said right and left wings are adjustable
23 to have angular motion asymmetrically, to cause asymmetric forces that tend to roll said vessel.

24
25 12. (original) The watercraft of claim 1 in which, when operating said vehicle at speed on
26 the surface of water, at least a portion of said wings are adapted to be permanently immersed in water
27 to generate upward forces and to raise the elevation of said watercraft and reduce said first
28

1 submerged volume, whereby drag is reduced.

2
3 13. (previously amended) The watercraft of claim 6 in which said trailing edge flaps and
4 said wings are adapted to be moved in coordinated fashion to accomplish pitch and path control, with
5 the trailing edge of said flap moving in opposite direction to the trailing edges of said wings.

6
7 14. (original) The watercraft of claim 6 in which the trailing edge of said flap and said wings
8 are adapted to be moved in the same direction to accomplish changes in heave.

9
10 15. (original) The watercraft of claim 1 in which said second volume is at least
11 approximately 50% of said first volume.

12
13 16. (currently amended) The watercraft of claim 1 in which the area of said wings (S_w)
14 is no less than the area obtained by dividing the buoyant force (L_{br}) generated by said second volume
15 when submerged, by the product of the dynamic water pressure q , at in said submerged speed times
16 a non-dimensional ~~number no less than approximately 0.3~~ lift coefficient C_L , whence $S_w = L_{br} /$
17 $C_L q$, with C_L values no less than approximately 0.3 and no greater than approximately 1.5 for
18 unflapped wings, and no greater than 2.5 for flapped wings ±6.

19
20 17. (canceled)

21
22 18. (canceled)

23
24 19. (currently amended) The watercraft of claim 4 in which the profile view of said
25 second volume said elongated body above water level is approximately a long triangle with long base
26 adjacent at waterplane.

Defy

20. (canceled)

21. (canceled)

22. (canceled)

23. (canceled)

24. (canceled)

25. (original) A surface and subsurface operational watercraft comprising:

a watercraft hull including;

a generally triangular water-engaging section including a pointed bow, horizontally extended stern and generally straight side walls extending divergently from said bow to said stern; and

a generally pyramidal surface section atop said water engaging section having left and right forward wall sections each respectively extending from and engaging the upper edges of one of said side walls and a rear wall section extending upwards from said stern; and

at least two attitude-adjustable water-engaging wings each mounted on and extending outwards from a respective one of said side walls of said water-engaging section, said wings operative to control submersion of said watercraft during movement of said watercraft via attitude adjustment thereof.

26. (original) The watercraft of claim 25 wherein said bow has a substantially deeper draft

1 | than said stern.

2 |
3 | 27. (canceled)

4 |
5 | 28. (currently amended) The watercraft of claim 41 ~~claim 27~~ wherein

6 |
7 | a) The weight of the water volume displaced by the watercraft when fully submerged is
8 | substantially larger than the weight of the watercraft.

9 |
10 | b) Right and left wings are provided extending laterally outboard of the sides of said elongated
11 | body when said watercraft has forward motion in submerged operation ~~at said water surface~~,
12 | said wings being capable of providing a downward force at least approximately equal to the
13 | difference between said ~~water~~ weight of said water volume and the weight of said watercraft
14 | ~~vessel~~.

15 |
16 | c) With said wings continuing to provide said downward force for continuous submerged
17 | operation.

18 |
19 | 29. (canceled)

20 |
21 | 30. (currently amended) The watercraft of claim 25 ~~claim 29~~ further characterized in
22 | that a traverse trailing edge flap is provided adjacent said stern ~~the base of said triangular planform~~,
23 | with said flap being deflected with its rearward trailing edge down when in forward motion ~~operating~~
24 | ~~at the surface~~ to cause said vessel to lower its pointed bow ~~submerge~~, and deflected with its rearward
25 | trailing edge up ~~when operating submerged~~ to cause said watercraft to raise its pointed bow upwards
26 | ~~vessel to surface~~.

1 31. (original) The watercraft of claim 30 further characterized in having a powerplant and
2 in that for a given position of wings and flap when operating submerged, depth control below water
3 is controlled in steady submerged navigation by changes in power level of said powerplant.
4

5 32. (currently amended) The watercraft of claim 25 ~~claim 22~~ further characterized in
6 having:

7
8 an overall streamlined external surface envelope of ~~said elongated body with a total body volume;~~

9
10 a primary interior dry volume having a structural midbody portion capable of supporting external
11 water pressures when submerged; and
12

13 at least a secondary internal volume ~~adjacent said ends~~ which is adapted to be flooded when ~~during~~
14 submerged ~~operation~~ to equalize pressures between water outside and inside said ~~external~~
15 ~~envelope in said~~ secondary volume.
16

17 33. (canceled)
18

19 34. (canceled)
20

21 35. (canceled)
22

23 36. The ~~A~~ watercraft of claim 25 further ~~capable of operating at surface and subsurface~~
24 ~~conditions~~ characterized in that having:

25
26 ~~an elongated central body with a longitudinal length;~~
27
28

1 said wings have mounted on said body having a hydrodynamic wing force center when submerged
2 in motion;

3
4 a first watercraft center of buoyancy ~~buoyance~~ when floating in surface condition ~~conditions~~;

5
6 and a second watercraft center of buoyancy ~~buoyance~~ when in submerged condition;-

7
8 with said second center of buoyancy and said hydrodynamic wing force center being located
9 longitudinally away from said first center of buoyancy, and in that a downward
10 hydrodynamic force on said hydrodynamic wings is additive to the gravitational weight force
11 of said watercraft and jointly oppose and tend to equilibrate the total buoyant forces acting
12 on said second buoyancy center.

13
14 37. (canceled)

15
16 38. (currently amended) The watercraft of claim 25 ~~claim 20~~ further characterized in
17 that said elongated body has an upper body portion above water level when operating at surface, said
18 upper body portion having an approximately triangular base planform adjacent said generally
19 triangular water engaging section, and an approximately triangular profile in side view to reduce
20 radar reflection.

21
22 39. (currently amended) The watercraft of claim 38 wherein said triangular profile in
23 side view is modified to be polygonal above the water plane, with the principal ~~outer~~ surfaces of said
24 upper body portion being faceted between planview and profile.

25
26 40. (currently amended) A surface and subsurface operational watercraft having an
27 elongated body with a forward end which is approximately wedge-shaped in planview with its
28

1 narrow end forward, a midbody region having right and left lateral surfaces and a bottom surface
2 extending between said right and left lateral surfaces, and a rearward end which is approximately
3 wedge-shaped in profile view with its narrow end rearward; said elongated body further
4 characterized in having in sideview ~~when submerged~~, a total height between top and bottom surface
5 portions of said elongated body adjacent said forward end which is substantially less than the total
6 planform width between right and left side surface portions of said elongated ~~of said body~~ adjacent
7 said rearward end, said total planform width of said rearward end being greater than any selected
8 planform width of said midbody region.

11 41. (currently amended) A surface and subsurface operational watercraft having an
12 elongated body with a forward end which is approximately wedge-shaped in planview with its
13 narrow end forward, a midbody region having right and left lateral surfaces and a bottom surface
14 extending between said right and left lateral surfaces and a rearward end which is approximately
15 wedge-shaped in profile view with its narrow end rearward; said elongated body further
16 characterized in having in sideview ~~The structure of claim 40 in which said total height~~ between
17 top and bottom surface portions of said elongated body adjacent said forward end is no greater than
18 approximately half ~~the said~~ total width between right and left side surface portions of said elongated
19 body adjacent said rearward end.

21 42. (currently amended) A surface and subsurface operational watercraft having an
22 elongated body with a forward end which is approximately wedge-shaped in planview with its
23 narrow end forward, a midbody region having right and left lateral surfaces and a bottom surface
24 extending between said right and left lateral surfaces and a rearward end which is approximately
25 wedge-shaped in profile view with its narrow end rearward; said elongated body further
26 characterized in having in sideview ~~when submerged~~, a) an overall height in sideview between upper
27 and lower surface portions of said elongated body located adjacent said midbody region ~~the middle~~

1 of said body which is less than the planform width between right and left sides of said elongated
2 body adjacent said rearward end, and b) having an overall height in side view between upper and
3 lower surface portions of said elongated body adjacent said forward end which is substantially less
4 than the planform width between right and left portions of said elongated body adjacent said
5 rearward end.

6
7 43. (currently amended) A surface and subsurface operational watercraft having an
8 elongated body with a forward end which is approximately wedge-shaped in planview with its
9 narrow end forward, a midbody region having right and left lateral surfaces and a bottom surface
10 extending between said right and left lateral surfaces, and a rearward end which is approximately
11 wedge-shaped in profile view with its narrow end rearward; said elongated body being further
12 characterized in that the included angle in profile of said rearward end is substantially greater
13 than approximately twice the included angle in planview of said forward end, the total planform
14 width between left and right side portions of said elongated body adjacent said rearward end being
15 greater than any selected planform width of said midbody region.

16
17 44. (currently amended) The structure of claim 40 further characterized in that said
18 elongated body has lateral right and left wing panels to provide substantially vertical forces during
19 said subsurface operation of said watercraft.

20
21 45. (previously added) The structure of claim 40 further characterized in that said
22 rearward end of said elongated body has upper and lower surfaces portions joined in an athwarship
23 rearward border, and in that a movable control surface is mounted on said rearward border.

24
25 46. (currently amended) A surface and subsurface operational watercraft capable of
26 resting stationary at bottom of a water body having an elongated body with a forward end which is
27 approximately wedge-shaped in planview with its narrow end forward, and a rearward end which
28

1 is approximately wedge-shaped in profile view with its narrow end rearward, said elongated body
2 ~~watercraft~~ further characterized in having a height in side view adjacent said forward ends which is
3 substantially less than the width of said elongated body adjacent said rearward end, an overall
4 streamlined ~~external~~ surface envelope of said elongated body with a total body volume; a primary
5 interior dry volume having a structural midbody portion capable of supporting external water
6 pressures when submerged; and a secondary interior volume ~~adjacent said narrow ends~~ which is
7 adapted to be flooded for stationary resting at the bottom of said water body with equal water
8 pressure during submerged operation to equalize pressures between water outside and inside said
9 secondary interior ~~external envelope in said secondary~~ volume.

10
11 47. (currently amended) The watercraft of claim 43 ~~claim 40~~ further comprising
12 ~~characterized in that said elongated body is adapted to be air-dropped from an aircraft, with a~~
13 ~~parachute connected adjacent said rearward end, whereby said elongated body is adapted to be air-~~
14 dropped from an aircraft, said parachute operative to establish ~~establishing~~ an approximately steady
15 decent rate with said forward end pointing towards a water body.

16
17 48. (currently amended) The watercraft of claim 41 ~~claim 40~~ further characterized in
18 that said elongated body is adapted for land operation with a retractable tricycle wheel arrangement.

19
20 49. (currently amended) The watercraft of claim 41 ~~claim 40~~ further characterized in
21 that said elongated body is adapted to move across a large wave with a transient submerged path
22 below the top of said wave.

23
24 50. (currently amended) The A surface and subsurface operational watercraft of claim
25 25 further characterized in ~~having an elongated body with a forward end which is approximately~~
26 ~~wedge-shaped in plan view with its narrow end forward, and a rearward end which is approximately~~
27 ~~wedge-shaped in profile view with its narrow end rearward; said elongated body having a principal~~

1 body surface envelope ~~portion~~ above water when in surface operation comprised by several flat
2 panels oriented in a generally and approximately streamlined disposition.

3
4 51. (currently amended) The A surface and subsurface operational watercraft of claim
5 47 having an elongated body with a forward end which is approximately wedge-shaped in plan view
6 with its narrow end forward, and a rearward end which is approximately wedge-shaped in profile
7 view with its narrow end rearward, said watercraft further characterized in having a powerplant
8 capable of imparting a forward thrust approximately parallel to the long dimension of said elongated
9 body, with said watercraft being adapted to be released above a water surface suspended from said
10 parachute with said forward end in an approximately downwardly direction, with said powerplant
11 being active to impart forward thrust ~~being active~~ when said forward end penetrates said water
12 surface, whereby said watercraft can continue to penetrate below said water surface under controlled
13 conditions against upward buoyant forces generated by said watercraft.

14
15 52. (previously added) The structure of claim 44 further characterized in that said
16 wings are adapted to be moved from a deployed position protruding laterally from said elongated
17 body, to a retracted position in which at least a substantial portion of said wings are positioned in
18 close proximity to said elongated body in a streamlined disposition.

19
20 53. (new) A transonic hull having a submerged portion with an approximate triangular
21 static waterplane at water surface, with a bow adjacent its narrow end, and a stern adjacent its broad
22 end; principal right and left side surfaces, and a principal lower surface extending between the lower
23 regions of said side surfaces, said transonic hull being further characterized in having a body above
24 said submerged portion, with said body having:

25
26 (a) a forward end adjacent said bow, a rearward end adjacent said stern, a longitudinal length,
27 and a midbody region;

1 (b) a generally triangular body planform adjacent said triangular waterplane with its narrow
2 portion adjacent said forward end and its broad portion adjacent said rearward end, with said
3 rearward end having an athwarship horizontal width;

4
5 (c) a lateral profile in side view with a body height adjacent said midbody region, said lateral
6 profile having a profile height distribution forward of said midbody region which decreases
7 substantially continuously towards said forward end free of radar-reflecting step discontinuities, with
8 a height adjacent said forward end substantially smaller than said body height adjacent said midbody
9 portion;

10
11 (d) a profile height distribution rearward of said midbody portion which extends continuously
12 toward said rearward end free of radar reflecting step discontinuities, with a height adjacent said
13 rearward end smaller than said athwarship horizontal width,

14
15 (e) said body being further characterized in having generally continuous surfaces extending from
16 lateral regions of said body planform to define a body volume above said body planform, with
17 horizontal planview sections of said body volume above said body planform generally free of radar
18 reflecting step discontinuities.

19
20 54. (new) The structure of Claim 40 further characterized in that said elongated body
21 has a principal submerged surface envelope portion comprised by several longitudinal flat panels
22 oriented in an approximately streamlined disposition.

23
24 REMARKS

25 Reexamination of this application is respectfully requested.

26 The antecedent basis and the indefiniteness rejections of the first and second paragraphs of
27 the office action are believed to have been resolved by amendments to the claims. Applicant further